The primary purpose of a blank sample is to identify potential sources of sample contamination and assess the magnitude of contamination with respect to concentration of target analytes (Appendix A4-B). There are many possible types of blanks, and the processing procedures described below and in Appendix A4-B address only those most commonly collected. (Additional information can be found in Branch of Quality Systems memorandums 92.01 and 95.01; Sandstrom, 1990; Horowitz and others, 1994; and Koterba and others, 1995, although terminology differs somewhat among these references.) Examples to estimate the volume of blank solutions needed for field QC and blank-collection protocols are given in Appendix A4-C.

4.3.1.A Source-Solution, Equipment, Trip, and Other Prefield Blanks

Prepare the source-solution blank, equipment blank, and trip blank before going to the field for environmental sampling. Wear gloves and conform to other clean-hands practices when working with blank solutions.

- **Source-solution blank.** Collect in a designated clean, draft-free area of the office laboratory, such as under a laminar-flow hood or laminar-flow bench. **Do not collect the source-solution blank in a fume hood.** Submit the sample for analysis along with field-collected samples.
- **Equipment blank.** Collect in a designated clean area of the office laboratory. Collect the equipment blank at least 4 weeks before using the equipment in the field to ensure enough time for chemical analysis and review of the resulting QC data.
- **Trip blank**. Carry the trip blank as received from the laboratory to the field site. Do not open, but store with the environmental samples collected for the same target analytes, and submit for analysis along with the field-collected samples. Record the trip-blank lot number on the NWQL Analytical Services Request (ASR) form submitted with the vial. (The lot number can be found on the box, and is sometimes printed on the label.)

A variety of other types of blank samples that are collected in the controlled office-laboratory environment can be designed to test some aspect of sample handling not related to field activities. Examples of this type of blank (described in Appendix A4-B) include the refrigerator blank, the shelf blank, and the preservation blank.

When working with blank water, wear disposable, powderless gloves and implement clean-sampling techniques.

Ambient and Field Blanks 4.3.1.B

The collection of blank samples, described in this section, addresses onsite (field) processing of blank water in the same environment in which the surface- or ground-water samples are collected and (or) processed.

To prepare for processing blank samples:

1. Label the capped, precleaned sample bottle with the site identification number, laboratory sample designation code (NFM 5), date, and time.
2. Put on gloves. Place each stock container of the blank solution to be used into clean plastic bags.
    - IBW—Required for trace-element, major-ion, and nutrient field-blank analysis.
    - PBW—Required for pesticide field-blank analysis; can be used as a blank for total or dissolved organic carbon (TOC/DOC).
    - VBW—Required for VOC field-blank analysis; can be used as a blank for TOC/DOC and pesticides.
3. If pumping blank water from a standpipe, change gloves and then rinse the precleaned standpipe three times using a small volume of blank solution of the type selected. Keep standpipe covered until use.
4. Change gloves. Place precleaned, labeled sample bottle(s) and the stock of blank solutions to be used into processing chamber.
    - IBW blanks—Discard the deionized water that half fills the precleaned polyethylene sample bottle. Rinse the sample bottle with a small quantity of blank solution and discard rinsate before filling with IBW.
    - PBW or VBW blanks—Do not prerinse the sample bottle. Use glass bottles or vials as received precleaned from the laboratory.

Ambient blanks

Ambient blanks are used to answer questions such as "To what extent could exposure of the sample to its collection and processing environment introduce measurable concentrations of target analytes?" Depending on the site characteristics or conditions being subjected to quality control, different procedures can be used for collecting the ambient blank. Three common procedures are described below. For each procedure, prevent contamination of the source solution and blank sample by capping the respective bottles immediately after use.

Procedure 1. Fill clean sample bottle(s) with the appropriate blank water in the same office-laboratory area in which the source-solution blank is collected, and transport to the field. Place the bottle(s) in the processing or preservation chamber or other area in which the environmental sample(s) are being processed. Open the blank-sample bottle to expose blank sample to the chamber atmosphere for the period of time in which the environmental sample(s) are being processed. Cap the bottle(s) and label appropriately.

Procedure 2. Working within the area being tested (usually the area in which the environmental sample is being collected or processed), pour blank water from the source-solution container directly into the sample bottle. Cap the bottle immediately and label appropriately. The goal is to use similar procedures to expose an identical volume of blank water to the ambient atmospheric conditions as that for collection of sample water.

Procedure 3. While working within the area being tested (such as a field vehicle), fill a clean, wide-mouthed container with the type of blank water desired and leave open to the atmosphere for the entire testing period. Pour the blank water into a clean sample bottle. Cap the bottle and label appropriately. (This type of ambient blank is sometimes referred to as an atmospheric blank.)

Field blanks

Field blanks are collected and processed at the field site in the same manner and using the same equipment as the environmental sample(s). Equipment must be meticulously cleaned for collection of field blanks (NFM 3). Field blanks answer questions such as "Has this component of the equipment system been adequately cleaned?" or "Does this equipment component introduce detectable concentrations of target analytes?" or "Is there carry-over contamination from the previous sampling site?"

- Field blanks can represent equipment components of the sampling system; for example, the sampler blank, splitter blank, filter blank, or pump blank. (The pump blank for ground water often is the same as or analogous to a sampler blank, when a pump is the type of sampler used to withdraw water from its original source.)
- A single field blank that represents the entire sampling system is commonly referred to as the field blank or field-system blank (fig. 4-8 and Appendix A4-B). The field blank is comprised of an aliquot of blank water processed sequentially through each component of the sampling system.

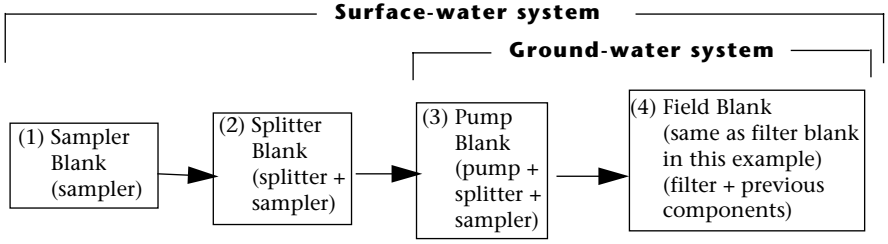
Submit field blanks for laboratory analysis of the same target analytes as the environmental sample(s). If the analytes being quality controlled are inorganic, preserved with acid, and are not time dependent, the sequential blank samples representing components of the sampling system and any associated source-solution and ambient blanks normally can be stored for up to 6 months.

1. If the field-blank data indicate constituent concentrations at acceptable levels, the associated set of sequential blanks can be discarded. (Be sure to use appropriate means for disposing of chemically treated solutions.)
2. If laboratory data indicate greater than acceptable concentrations:
   a. Submit the source-solution blank, ambient blank(s), and equipment-component blank(s) (the sampler blank, splitter blank, pump blank, and so forth) to the laboratory for analysis.
   b. Use the data from equipment-component blank samples to identify the source(s) of contamination detected in the field blank.
   c. **Take appropriate measures to eliminate contamination during future sampling trips.**

EXAMPLE PROCEDURE FOR COLLECTING FIELD BLANKS

A set of blanks can be generated that is associated with the field blank to help determine which equipment component in the system could be a source of contamination. The **field blank** is the final sample that represents all equipment components of the sampling system. After each blank sample is collected, preserve and store sample as required.

- **Follow steps 1 through 4 to process a surface-water field blank.** In this example, the equipment used includes a US D-77 sampler, 8-liter (L) churn splitter, peristaltic pump, and filter assembly.
- **Follow steps 3 and 4 to process a ground-water field blank.** In this example, the equipment used includes a submersible pump and a filter assembly.



(1) Sampler Blank. Using the blank water selected, rinse and then fill the sampler; attach sampler cap and nozzle; pour the required volume through nozzle into sample bottle.

(2) Splitter Blank.[1] Rinse churn splitter with blank water. Pour the blank water remaining in the sampler through the sampler nozzle and into the 8-L churn splitter. Refill sampler, repeat until churn contains 3 to 5 L of blank water. Process the required blank-sample volume through the churn spigot into the splitter-blank bottle. (If a cone splitter is used instead of a churn splitter, the blank sample is processed through the exit port tubes.)

(3) Pump Blank.[1]

- **Surface-water example**: Using the peristaltic pump, thread the intake end of clean tubing into churn splitter through the funnel, and cap the funnel loosely. Insert the discharge end of the pump tubing into a processing chamber and pump blank water through the tubing for an initial rinse, discharging rinse water to waste. After the rinse, pump the required volume of blank water from the churn splitter into the pump-blank bottle.
- **Ground-water example:** Rinse a precleaned, noncontaminating standpipe with blank water and discard rinse water. Place submersible pump into the standpipe and pour in blank water—keep water level above the pump intake. Insert discharge end of pump tubing into a processing chamber. Circulate blank water through pump and tubing to rinse, discharging rinse water to waste. Pump the required volume of blank water from the standpipe into the pump-blank bottle.

(4) Field-System Blank (the field blank). The **field blank** in this example is the same as a special type of **filter blank**[1] because the filter assembly is the final component of the equipment system through which the blank is processed. Working in the processing chamber, precondition the filter with blank water (NFM 5).

- **Surface-water example:** Pump the required volume of blank water from the churn splitter through the prerinsed filter assembly into the field-blank bottle.
- **Ground-water example:** Pump the required volume of blank water from the standpipe through the prerinsed filter assembly into the field-blank bottle.

[1]These are special cases of a splitter blank, pump blank, and filter blank, respectively, because the equipment component named is the final component but not the only component contacting the blank sample.

Figure 4-8. Example of procedure for collecting field blanks and associated blank samples.